DOCUMENT RESUME

ED 266 016 SE 046 398

TITLE	Physical Oceanography of the Eastern Mediterranean (POEM): A Research Programme. Reports of the Organizing Committee Meeting (Paris, August 1984), and the Scientific Workshop (Lucerne, October 1984). Unesco Reports in Marine Science 35.
INSTITUTION	United Nations Educational, Scientific, and Cultural Organization, Paris (France). Div. of Marine Sciences.
PUB DATE	85
NOTE	77p.
AVAILABLE FROM	Marine Information Centre, Division of Marine Sciences, Unesco, 7, Place de Fontenoy, 75700 Paris, France.
PUB TYPE	Reports - Research/Technical (143) -- Collected Works - Conference Proceedings (021)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	Foreign Countries; Higher Education; *Oceanography; Program Content; *Research Projects; *Scientific Research
IDENTIFIERS	*Mediterranean Region

ABSTRACT

The ultimate goal of the Program for the Exploration of the Eastern Mediterranean (POEM) is to reach a comprehensive knowledge of the physical, chemical, and biological oceanography of the Eastern Mediterranean. Such knowledge is an essential basis for environmental management, resource exploration, and marine operations. The overall scientific objectives are to: (1) describe the physical phenomena and quantify their kinematics; (2) define basic dynamical processes; and (3) construct physical models suitable for general ocean scientific studies and applications. This report on POEM consists of two parts. The first part, the report of the Paris meeting, discusses the scientific plan, the field program, data management, and modeling, with descriptions of relevant national programs in nine countries provided in appendices. These countries are Egypt, France, West Germany, Greece, Israel, Italy, Turkey, Cyprus, and the United States. A list of participants is also provided. The second part, the report of the Lucerne workshop, discusses: phenomenology and kinematics; general circulation; mesoscale dynamics; water mass formation; and air-sea interaction and remote sensing. Summaries of round table discussions on biological and chemical implications, data banks for the eastern Mediterranean, and methodologies/techniques are also included. The meeting agenda and a list of participants are provided in the appendices. (Author/JN)

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Physical oceanography of the Eastern Mediterranean (POEM): A Research Programme

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Reports of the
Organizing Committee Meeting,
Paris, August 1984, and the
Scientific Workshop,
Lucerne, October 1984

SE 046 398

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20	Quantitative analysis and simulation of Mediterranean coastal ecosystems: The Gulf of Naples, a case study Report of a workshop on ecosystem modelling Ischia, Naples, Italy, 28 March to 10 April 1981 Organized by the United Nations, Educational, Scientific and Cultural Organization (Unesco) and the Stazione Zoologica, Naples English only	1983
21	Comparing coral reef survey methods A regional Unesco/UNEP workshop, Phuket Marine Biological Centre, Thailand, December 1982 English only	1983
22	Guidelines for marine biological reference collections Prepared in response to a recommendation by a meeting of experts from the Mediterranean Arab countries Available in English, French and Arabic	1983
23	Coral reefs, seagrass beds and mangroves: their interaction in the coastal zones of the Caribbean Report of a workshop held at West Indies Laboratory, St. Croix, U.S. Virgin Islands, May, 1982 English only	1983
24	Coastal ecosystems of Latin America and the Caribbean The objectives, priorities and activities of Unesco's COMAR project for the Latin America and Caribbean region Caracas, Venezuela, 15-19 November 1982 Available in English and Spanish	1983
25	Ocean engineering teaching at the university level Recommended guidelines from the Unesco/IOC/ECOR workshop on advanced university curricula in ocean engineering and related fields, Paris, October 1982 Available in English, French, Spanish, Russian, Arabic and Chinese	1983
26	Global survey and analysis of post-graduate curricula in ocean engineering English only	1984
27	Productivity and processes in island marine ecosystems. Recommendations and scientific papers from the Unesco/IOC sessions on marine science co-operation in the Pacific, at the XVth Pacific Science Congress, Dunedin, New Zealand, February 1983 English only	1984
28	Oceanographic modelling of the Kuwait Action Plan (KAP) Region. Report of simposium/workshop; University of Petroleum and Minerals, Dhahran, Kingdom of Saudi Arabia 15-18 October 1983 English only	1984
29	Eutrophication in coastal marine areas and lagoons: a case study of 'Lac de Tunis' Report prepared by Dr M. Kelly and Dr M. Naguib English only	1984
30	Physical oceanography of the Eastern Mediterranean: an overview and research plan Report of a workshop held in Lerici, La Spezia (Italy), September 1983 English only	1984
31	MABAHISS/John Murray 50th anniversary: Marine science of the North West Indian Ocean and adjacent waters Report of a symposium on the occasion of the 50th anniversary of the MABAHISS/John Murray Expedition (1933/34), University of Alexandria, Egypt, 3 to 7 September 1983 English only	1985
32	L'estuaire et la mangrove du Sine Saloum Résultats d'un Atelier régional Unesco-COMAR tenu à Dakar (Sénégal) du 28 février au 5 mars 1983 French only	1985
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PREFACE

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ABSTRACT

The ultimate goal of the Programme for the Exploration of the Eastern Mediterranean (P.O.E.M.) is to reach a comprehensive knowledge of the physical, chemical, and biological oceanography of the Eastern Mediterranean. Such a knowledge is an essential basis for environmental management, resource exploitation, and marine operations.

The overall scientific objectives are (i) describe the physical phenomena and quantify their kinematics; (ii) define basic dynamical processes and (iii) construct physical models suitable for general ocean scientific studies and applications. This Report on P.O.E.M. summarizes the scientific and practical objectives of the programme, delinates the elements of the scientific plan, the means of accomplishing the goals, and the schedule of events. It was developed from the substantial scientific planning workshop report 'Physical Oceanography of the Eastern Mediterranean, An Overview and Research Plan' UNESCO Report in Marine Science No. 30, at a meeting of the Organizing Committee held at UNESCO Headquarters in Paris on August 1984.

RESUME

Le but ultime du Programme pour l'exploration de la Méditerranée orientale (POEM) est une connaissance approfondie de l'océanographie physique, chimique et biologique de la Méditerranée orientale. Cette connaissance constitue une base indispensable à la gestion du milieu, à la mise en valeur des ressources et aux activités marines.

Les objectifs scientifiques globaux sont les suivants : (i) décrire les phénomènes physiques et déterminer quantitativement leur cinématique ; (ii) définir les processus dynamiques fondamentaux et (iii) construire des modèles physiques qui conviennent à des études scientifiques générales en océanologie et à leurs applications. Le présent Rapport sur le POEM récapitule les objectifs scientifiques et pratiques du programme, expose les éléments du plan scientifique ainsi que les moyens d'atteindre les buts et indique le calendrier des événements. Il a été mis au point lors d'une réunion du Comité d'organisation tenue au Siège de l'Unesco à Paris en août 1984, sur la base du rapport substantiel de la réunion de travail consacrée à la planification scientifique intitulé "Physical océanography of the Eastern Mediterranean : an overview and research plan" (Océanographie physique de la Méditerranée orientale : aperçu général et plan de recherche) et publié dans la collection "Rapports de l'Unesco sur les sciences de la mer" (n° 30).

RESUMEN

La meta definitiva del Programa para la Exploración del Mediterráneo Oriental (POEM) consiste en adquirir un conocimiento general de la oceanografía física, química y biológica del Mediterráneo Oriental. Este conocimiento constituye una base esencial para la ordenación del medio ambiente, la explotación de los recursos y las operaciones marítimas.

Los objetivos científicos generales son i) describir los fenómenos físicos y hacer mediciones cinemáticas; ii) definir los procesos dinámicos básicos y iii) construir modelos físicos adecuados a los estudios y aplicaciones científicas generales relativos al océano. Este Informe sobre el POEM resume los objetivos científicos y prácticos del programa, determina los elementos del plan científico, los medios de alcanzar los objetivos y el calendario de actividades. Fue elaborado a partir del notable informe del seminario de planificación científica: "Physical Oceanography of the Eastern Mediterranean, An Overview and Research Plan" (Oceanografía Física del Mediterráneo Oriental, Perspectiva General y Plan de Investigaciones), Informe de la Unesco sobre Ciencias del Mar n° 30, en una reunión del Comité Organizador celebrada en la Sede de la Unesco, de París, en agosto de 1984.

РЕЗЮМЕ

Основной целью Программы исследований Восточного Средиземноморья (ПИВС) является всестороннее изучение физической, химической и биологической океанографии Восточного Средиземноморья. Такие знания являются необходимой основой для управления окружающей средой, освоения ресурсов и проведения морских операций.

Общими научными целями являются (i) описание физических явлений и определение количества их кинематических характеристик; (ii) определение основных динамических процессов и (iii) построение физических моделей, которые могли быть использованы для общих океанографических научных исследований и практического применения. В этом докладе по ПИВС кратко излагаются научные и практические цели программы, элементы научного плана, средства достижения целей и график событий. Он был подготовлен на основе обстоятельного доклада семинара по научному планированию "Физическая океанография в Восточном Средиземноморье: обзор и план исследований" (доклад ЮНЕСКО по морским наукам № 30) в ходе совещания Организационного комитета, проведенного в Штаб-квартире ЮНЕСКО в Париже в августе 1984 года.

خلاصة

يتمثل الهدف النهائى لبرنامج استكشاف شرقى البحر المتوسط فى التوصل الى معرفة شاملة بالاوقيانوغرافيا الفيزيائية والكيميائية والبيولوجية لشرقى البحر المتوسط، اذ تعتبر هذه المعرفة أساسا لا غنى عنه للادارة البيئية واستغلال الموارد والعمليات البحرية .

وتتمثل الأهداف العلمية العامة فيما يلى : (١) وصف الظواهر الفيزيائية والتقدير الكمى لحركتها المجردة . (٢) تحديد العلميات الدينامية الأساسية . (٣) اعداد نماذج فيزيائية تلائم الدراسات والتطبيقات العلمية المحيطية العامة .

ويلخص هذا التقرير عن برنامج استكشاف شرقى البحر المتوسط الأهداف العلمية والعملية للبرنامج ويصف عناصر الخطة العلمية، ووسائل تحقيق الأهداف ، والجدول الزمنى للأحداث . وقد أعد فى اجتماع عقدته اللجنة المنظمة فى مقر اليونسكو بباريس فى أغسطس / آب ١٩٨٤ ، استنادا الى التقرير الهام لحلقة العمل المعنية بالتخطيط العلمى المعنون "الاوقيانوغرافيا الفيزيائية لشرقى البحر المتوسط ، استعراض شامل وخطة عمل" والذى يرد فى العدد رقم ٣٠ من تقارير اليونسكو فى علوم البحار .

提　要

东地中海考察计划（P.O.E.M）的最终目标是达到对东地中海的物理、化学和生物海洋学的全面认识。具有这样的认识是进行环境管理、资源利用和海洋活动的所必需的基础。

总的科学目标是：（i） 描述物理现象并对它们的运动学予以定量，（ii）确定基本的动态学的过程以及（iii）建立适合于海洋综合科学研究和应用的物理模型。关于东地中海考察计划的这一报告，总结了本计划的科学及实际目标，叙述其科学规划的内容、完成任务的方法以及活动日程表。本报告是由富有内容的科学规划讲习班报告“东地中海的物理海洋学——概述和研究规划”发展而来的，后者即１９８４年8月于巴黎教科文组织总部召开的组织委员会的一次会议上提出的《教科文组织海洋科学报告第３０号》。

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PART I

PHYSICAL OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN (POEM)

THE PROGRAM AND THE PLAN

REPORT OF THE ORGANIZING COMMITTEE MEETING
PARIS, 7-9 AUGUST 1984

FOREWORD

This concise statement of POEM summarizes the scientific and practical objectives of the program, delineates the elements of the scientific plan, the means of accomplishing the goals, and the schedule of events. It was developed from the substantial scientific planning workshop report 'Physical Oceanography of the Eastern Mediterranean, An Overview and Research Plan' UNESCO Technical Report in Marine Science No. 30, at a meeting of the Organizing Committee held at UNESCO headquarters in Paris on August 1984 (see Appendix 2). We are indebted to Ms. Marsha Glass of Harvard University and Dr. Makram Gerges at UNESCO for their invaluable help in arranging for POEM. We thank the UNESCO Division of Marine Science and the US National Science Foundation for their support of participants at the meeting.

Allan R. Robinson and Paola Malanotte-Rizzoli
Co-chairpersons

Cambridge, Massachusetts USA,
21 December 1984

Final text adopted by the POEM Steering Committee, Paris, France, on 15 June 1985.

Allan R. Robinson and Paola Malanotte-Rizzoli
Co-chairpersons

1. INTRODUCTION

POEM (Physical Oceanography of the Eastern Mediterranean) is a scientific research program for the Eastern Mediterranean Sea. It is to be carried out cooperatively in the second half of this decade by scientists from several countries, many of whom have worked together for over two years to construct a definitive and balanced plan. The main thrust of the initial program is basic research in physical oceanography. Observations, experiments and modelling are essential to determine the circulation, its variabilities and associated transports. The ultimate programmatic goal is to achieve a comprehensive knowledge of the physical, biological and chemical oceanography of the sea and its interactions with the overlying atmosphere, submarine basin, and surrounding coasts. This knowledge is necessary for practical activities in applied marine technology which benefit greatly our society, environmental management, renewable and nonrenewable resources and marine operations are implicated including, e.g. fisheries development, pollution control, oil exploration and the economics of climatic change.

Scientific interest in the Eastern Mediterranean, which is today one of the most poorly known regions of the world ocean, arises for two major reasons. The first is the obvious regional importance of new scientific knowledge of the sea to the nations surrounding it. The second is the profound interest in general physical processes which occur there, which can be studied relatively easily and efficiently. The formation of dense water masses at the sea surface is a vital part of the world ocean convective circulation, as it functions as a massive heat engine But suth formations are rare and episodic, and are known to occur at all only in a very few locations, occupying less than one percent of the oceans surface. Formations occur predominantly in polar regions where the logistics of research are extremely difficult and in the Mediterranean. Salt released by ice formation in polar regions and salt left behind by intense evaporation over the Mediterranean lead to analogous processes. General processes of dispersion and mixing occur vigorously because of the juxtaposition of waters of quite different properties. Although small, the almost isolated wind and thermohaline driven Eastern Mediterranean is large enough for its internal dynamics to be characteristic of the dynamics that governs the currents of the general circulation of the major ocean basins. Yet the Eastern Mediterranean is small enough to be sampled essentially synoptically and with adequate resolution over the entire basin. It is possible with present day large computers to simulate the Eastern Mediterranean with adequate resolution in both the horizontal and vertical grids, which is essentially impossible in the larger basins. As they prepare for the large, general circulation and climate studies of the 1990's, globally oriented ocean scientists regard the Eastern Mediterranean as a laboratory basin for timely general studies. It is real and fortuitous circumstance that ocean scientists from the world's forefront research laboratories and scientists from the oceanographic research institutes of the Eastern Mediterranean share common and overlapping research goals.

It is an exciting time to launch such a concerted research effort and POEM, which will hopefully transform the Eastern Mediterranean from one of the most poorly known to one of the best known regions of the world's ocean, is entirely feasible. Ocean science, and particularly physical oceanography, is in a rapid state of evolution and development. New sampling techniques, instruments, methods and models are being utilized. Most of what we know today has been

discovered recently. The North Atlantic Ocean is perhaps the best known basin in the world. Yet a realistic description of its phenomenology (eddies, rings, fronts, jets, meanders) was achieved only during the 1970's. The POEM plan requires a mix of classical observational surveys and modern special purpose experiments. The design and interpretation of contemporary oceanographic research utilizes methods which emphasize efficiency in resource utilization via the optimal blending of observations and modelling results. The resources of existing national ocean research groups surrounding the Eastern Mediterranean include generally well trained scientists, and adequately instrumented ships and laboratories. Pooled together with the scientific expertise and the special techniques brought to bear by interested colleagues from forefront research institutes elsewhere, (transient tracer studies, advanced dynamical computer models, remotely sensed data, etc.) the means of accomplishing the substantial scientific goals of POEM are available.

The major scientific products of POEM will be a definitive, composite and shared set of data which describes the basic phenomena which occur and which will serve as the basis for permanent dynamical understanding of the region. Theories and models will be constructed, culminating in a state-of-the-art modern circulation model. This model will assimilate and synthesize the data, summarize the dynamical understanding, and serve as the vehicle for the application of the new physical knowledge to biological and chemical research, coupled air-sea climate studies, and practical applications. It is intended that the circulation models will ultimately be shared by all participating scientists and institutions, and will have useful versions which run on both large and small computers. Successfully completed, these studies will impact significantly our understanding of, and research directions for, the global general circulation.

Working together with a broader base of ocean scientists in POEM, scientists from the regional institutes can rapidly advance in techniques and knowledge to the forefronts of contemporary ocean science, and develop life-long colleague relationships.

2. SCIENTIFIC PLAN

2.1 ULTIMATE GOAL

The ultimate goal of P.O.E.M. is to reach a comprehensive knowledge of the physical, chemical, and biological oceanography of the Eastern Mediterranean. Such a knowledge is an essential basis for:

- environmental management
- resource exploitation
- marine operations.

2.2 SCIENTIFIC OBJECTIVES

2.2.1 OVERALL SCIENTIFIC OBJECTIVES

These are:

A. Describe the physical phenomena and quantify their kinematics
B. Define basic dynamical processes
C. Construct physical models suitable for general ocean scientific studies and applications

2.2.2 SPECIFIC SCIENTIFIC OBJECTIVES

The specific objectives of the POEM Program are listed under the following four major scientific components:

i) Definitive phenomenology of hydrography, currents, transports
- general features, their kinematics and variabilities
- fluxes, transports and overall budgets
- local dynamical processes and balances

ii) Dynamics of the Circulation and Currents
- major driving mechanisms (wind, buoyancy, source/sinks)
- role of air-sea interactions and of feedback mechanisms
- internal dynamical processes, mesoscale variability and energetics
- mesoscale/mean field interactions
- climatic processes

iii) Water mass formation, spreading and transformation
- preconditioning phenomena and the statistics of events
- detailed physical processes of intermediate and deep convection
- dispersion and mixing mechanisms
- parameterization

iv) Implications of the circulation
- transports and distributions of biological and chemical properties
- determination of critical interdisciplinary process research problems

2.3 FIELD EXPERIMENTS

The major FIELD EXPERIMENTS to be carried out consist of:

i) General hydrographic surveys covering the whole Eastern Mediterranean carried out almost synoptically and with synoptic/mesoscale resolution, for studies of the general circulation and identification of preconditioning phenomena and water mass formation sites
ii) Localized, high resolution hydrographic surveys in regions of intense dynamic activity for the study of mesoscale processes, their variability and energetics
iii) Localized, high resolution hydrographic surveys in the identified regions of intermediate (Levantine) water formation for the studies of deep convection processes, mixing and water mass dispersion
iv) Lagrangian float experiments for dispersion
v) Monitoring of straits (Sicily, Otranto, Greek Straits) with current-meter moorings and tide gauges for the study of water mass exchanges and transports between the various basins
vi) A general survey of the whole Eastern Mediterranean for tracer measurements (Tritium, Helium 3, Freon) for the studies of the general circulation and water mass spreading as inferred from tracer distribution
vii) Remotely sensed surface data from satellites and other platforms.

2.4 MODELS

The MODELS to be used will be:

i) Models for the general circulation of the Mediterranean (GCM)
ii) Eddy resolving models for mesoscale dynamical processes
iii) Specialized versions of the above models for water formation and deep convection process studies
iv) Advection-diffusion models for passive and active oceanic tracer
v) Models of coastal circulation and shelf areas to be coupled with the GCM
vi) Atmospheric GCM in the limited area over the Mediterranean to be coupled with the Mediterranean GCM

2.5 METHODOLOGY

The methodology of approach will bear upon the coupling of the experimental field program and the modelling studies. It includes:

i) Field measurement from shipboard (hydrographic data); moored and free floating instruments; tracer studies as obtained from the experimental field plan
ii) Satellite and other remotely sensed data
iii) The models for the general circulation, mesoscale dynamics and physical processes
iv) The combination of models and data in sophisticated, new techniques for optimal field estimates, data initialization, assimilation and updating into models, inverse methodologies.
v) The synthesis of existing and new data for a definitive phenomenology of the Eastern Mediterranean; data sharing and pooling, synthesis of program accomplishments.

3. FIELD PROGRAM

3.1 GENERAL CIRCULATION

These coordinated surveys are of central importance to the success of our scientific program. The hydrographic investigation of the Eastern Mediterranean Sea requires some 320 stations, not all of them distributed with the same density. For instance, while in the active region of Levantine intermediate water formation in the Levantine Basin, stations will have to be spaced at 0.5° intervals at least, in the Ionian Basin where one is mainly interested in following the spreading of deep and bottom waters, a coarser grid may be quite sufficient. Moreover, not all the stations will have to be sampled right down to the bottom. On the one hand, in a very dense grid, the ship drift, which is implicit when sampling down to the bottom i.e. for a long time, will carry the ship from one station to another. On the other hand, deep Mediterranean waters, that is below 1,500m, tend to be quite uniform and close spaced sampling does not contribute additional information.

Scientists in the following countries have expressed interest and have the scientific capability of investigating the region and accordingly, we estimate that the regions in Fig. (1) could be covered as follows. The 400 stations will be repeated four times during each of the recommended hydrographic surveys.

Italy: 100-110 stations in the Adriatic and in the Ionian Sea. (Region I - Fig. 1)

Greece: 60-70 stations in the south Aegean sea, south and southeast of the Crete and Rhodes arc, the passages between the Aegean and the Mediterranean seas and/or a number of stations in the Ionian sea ares (Region II - Fig. 1)

Turkey: 100 stations in the northern Levantine Basin (Region III - Fig. 1)

Israel: 80 stations in the southern Levantine Basin (Region III - Fig. 1)

Egypt: 60 stations in the coastal zone and southern Levantine Basin (Region III - Fig. 1)

Germany: Will carry out a coarsely spaced cruise with the Meteor in July-August 1987, covering the entire Eastern Mediterranean Sea.

France: Will employ remote sensing techniques for the description of surface properties of the entire Eastern Mediterranean Sea, and the Aegean Sea.

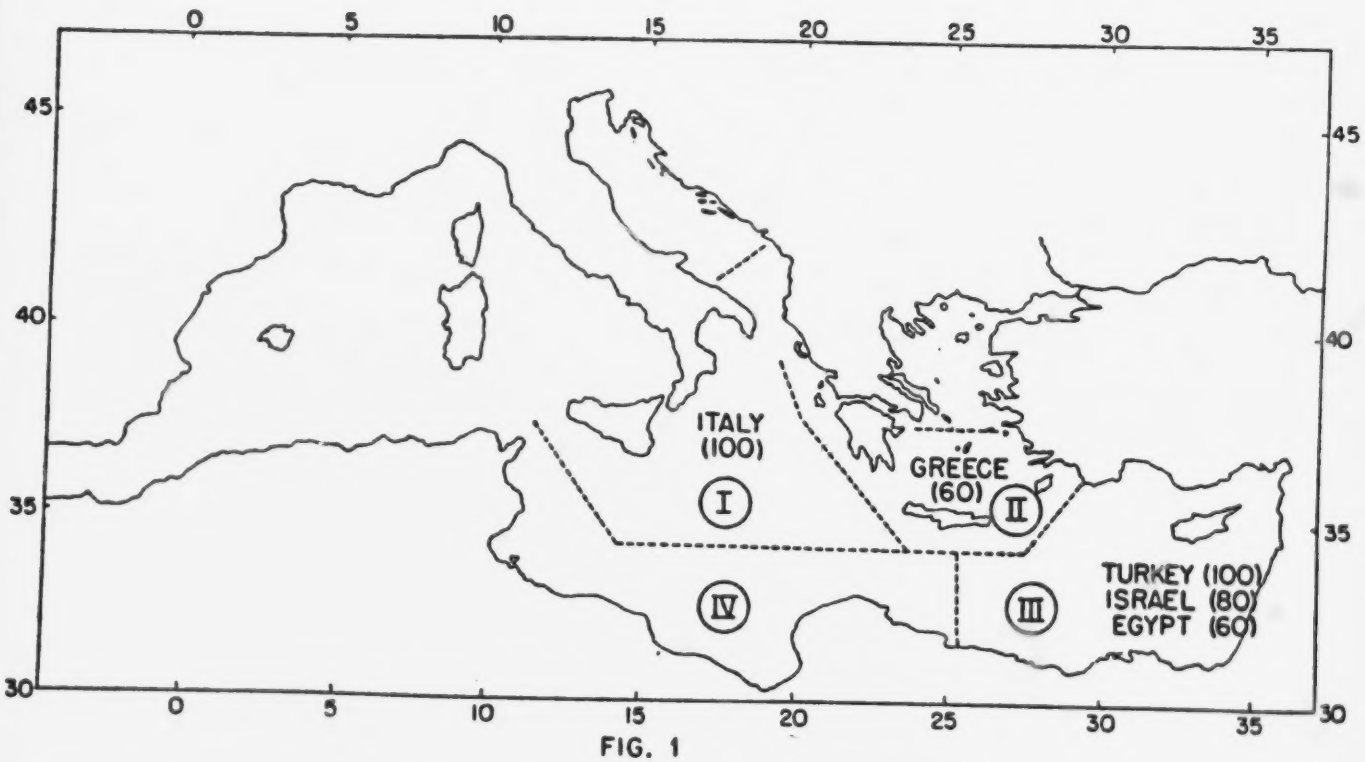

0
5
10
15
20
25
30
35
45
40
35
30
ITALY
(100)
I
GREECE
(60)
II
TURKEY (100)
ISRAEL (80)
EGYPT (60)
III
IV
FIG. 1

FIG. (1)

It would be extremely valuable to obtain coverage also of the the south-western part of the Eastern Mediterranean, off the Libyan/Tunisian Coast (Region IV - Fig.1). The importance of the data set obtained from the coverage of the Mediterranean regions sketched in Fig.1 would be greatly increased by obtaining data for region IV as well. If this highly desirable option could not be achieved, the data set obtained for region I, II, and III will still be extremely valuable, and dynamical interpolation through numerical modeling would be used for region IV.

It is desirable that scientists in Italy, Greece, Turkey, Egypt and Israel carry out two cruises per year in mid-October 1985, March 1986, October 1986 and March 1987. Strips of stations located at the margins of the areas of interest will overlap so as to enable intercalibration and intercomparison of data. Each such cruise will last for approximately 45 days. CTD measurements will be obtained on all the stations from the surface to 1,500m depth and on selected stations to the bottom. Water samples will be obtained, temperatures and pressures will be measured with bottles and reversing thermometers at selected depths and precision bathymetric measurements should be routinely carried out. Additional biological and chemical sampling at a limited number of stations will be considered. Samples for tracers (Tritium and Helium) will be obtained on a limited number of stations according to methods and procedures established by the group at the Heidelberg University (see Appendix 1-III).

It is anticipated that scientists from one or more other institutions will work aboard the vessels gathering the data together with the scientists from that vessel's institution and will further participate onshore on the initial data reduction.

3.2 MESOSCALE DYNAMICS

It is well known that synoptic/mesoscale eddies dominate energetically much of the flow in the major mid-latitude gyres. These eddies are the 'internal weather' of the ocean and vary in space and time on scales of 10 to 100 km and from days to months. Eddy currents are related to the fields of temperature, salinity and density; they transport and disperse dissolved material and affect marine operations. Moreover, the eddies are generally known, through non-linear interactions, to vitally affect the dynamics of the general circulation.

The characteristics of Mediterranean eddies are not well known. Data of sufficient synopticity, accuracy and a high resolution sampling are necessary to establish the general features of the mesoscale eddy field, the dynamics of eddy frontal regions, their energetic and variability, and, in general, for dynamical studies. The average Eastern Mediterranean vertical stratification indicates that the Mediterranean eddy field may be quite different from that typical of other regions of the world ocean (like the North Atlantic). Consequently, non-linear dynamical interactions may play quite a different role in establishing the modes of internal dynamics.

The objectives of the mesoscale dynamics experiment are therefore:

a) to describe and predict the fields of mesoscale currents and associated density patterns.
b) to use these field estimates in conjunction with real data for data assimilation and model updating
c) to relate the mesoscale eddy field to general circulation dispersion studies
d) to enable the use and testing of models for practical purposes, experimental planning and design

Present knowledge of the Eastern Mediterranean indicates the four regions shown in Fig. 2 as the potential meso-scale study areas. Within these regions as well as in those to be identified later, a station grid-network with 8 km spacing will be established. Expandable bathythermographs (XBT) will be dropped at each station. CTD casts will be made at stations 24km apart.

Current meters will be deployed in the study areas. The number of arrays to be deployed and the duration of current measurements are subject to the results of the initial surveys.

The estimated shiptime for such the meso-scale studies is 100 days, evenly distributed between the months of March and October in the year 1986.

3.3 WATER MASS FORMATION AND DISPERSION

Three water masses are identified for formation, spreading and mixing studies:

A. Levantine Water (later on, the so-called Mediterranean intermediate water, between Rhodes and Cyprus islands).
B.1. Aegean deep water (mainly the one formed in the South Aegean Sea between Cyclades and Crete).
B.2. Adriatic deep water formed in the Southern Adriatic Sea.

In order to document properly the formation processes which follow the preconditioning phase (documented during the general or large-scale survey) we have to concentrate hydrographic surveys in regions like 100 x 100 kms, identified during general surveys. An appropriate regular grid-spacing for that purpose would be a 20 kms (around 10 miles) which corresponds to 25-30 stations with a possibility of extending the grid spacing down to the internal radius of deformation (around 5 kms) across regions showing up baroclinic features like fronts.

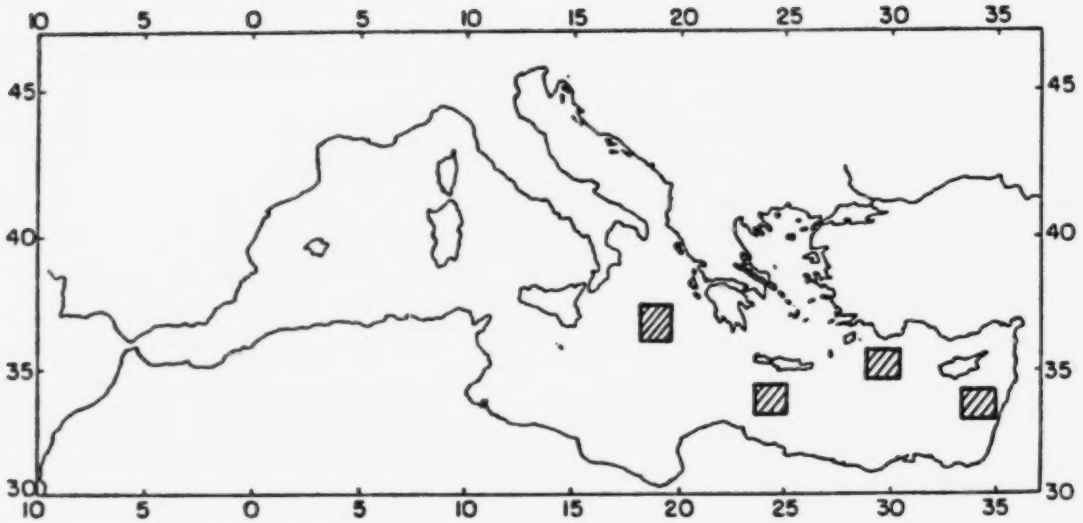


FIG. 2. Potential regions for Meso-scale Dynamics Experiment.

FIG. (2)

A. Levantine Water

i. Formation

The main area is located south of Turkey (see Area A-Fig. 3a). How far south should come out from the general survey as well as from the tracer survey. A general survey has to be repeated twice a year (early fall and late winter) during the two years field experiment and to be carried out under the responsibility of the Turkish ship. In addition, one summer cruise (August 1986) should be undertaken covering southeast Aegean Sea and northwest Levantine Basin (Area B in Fig. 3a). This will be under the responsibility of a Greek ship. In order to avoid the overlapping of Turkish and Greek ships, the coordinates of the areas reserved for Turkish and Greek ships should be very well defined so that there will not be a misunderstanding in the future.

In conjunction with these in situ measurements, the forcing field should be adequately sampled using classical meteorological parameters and remotely sensed parameters like SST and wind stress and surface currents in order to check for the validity of 1D classical mixed layer model versus 2D (cf. remote sensing section). This remote sensing programme will be undertaken by French scientists and will cover all the years starting in 1985.

In addition to the hydrographic in situ measurements, we plan to run simultaneously a Lagrangian experiment during the winter season to get some idea about the intensity of convection and infer from it the Levantine Intermediate Water formation rate, and finally calculate the volume of renewed water. This experiment should be repeated twice during winter of 1986 and 1987 by French oceanographers (Area A - Fig. 3a). Winter of 1986 should be considered as a pre-experiment for defining more precisely a strategy of float deployment in winter of 1987. The tracer survey should give additional information on formation rates.

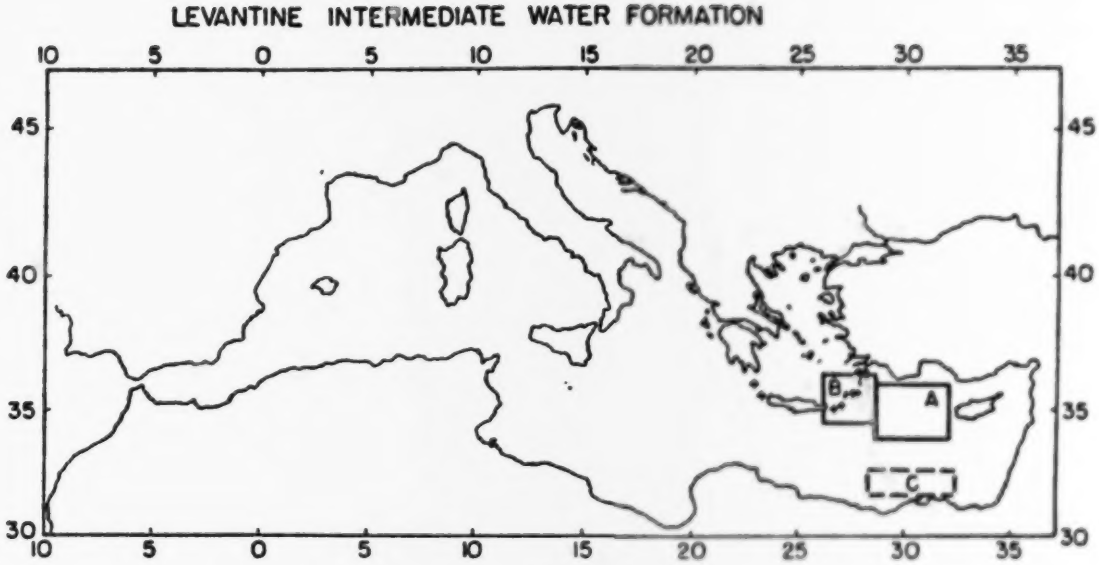
ii. Spreading and Mixing

A necessary complement of the mentioned mesoscale floats experiment for spreading studies is large-scale floats experiment planned in Fall 1986 and in conjunction with the tracer cruise, 1987, using pop-up floats under development in France, using Argos for location. The sampling strategy for these pop-up floats has to be considered in conjunction with the tracer experiment planned at the same time by a ship from of the Federal Republic of Germany, the idea being that the tracer data will extend the spreading information to larger scales.

In addition, current meter moorings will give the necessary information in the straits between Levantine Basin and Aegean Sea (cf. straits measurements) which will be collected by Greek scientists. The possibility of having Levantine water formation in the southern Levantine basin (Box C - Fig. 3a) is not out of discussion. A possible intensive survey is to be decided after the general survey of 1985.

B. Deep Water

The strategy during the field experiment will be nearly the same as for the LIW formation studies, except for the following: time for physical observations



A. Intensive studies during fall and winter.
B. Intensive study during summer.
• Currentmeter moorings.

FIG. 3a

FIG. (3A)

should be restricted during winter season in 1986 and 1987. Again, the tracer survey will add information both on the formation rates and on spreading and mixing.

Note: Mesoscale floats experiment could be conducted at the same time, both for LIW studies and DW formation in the South Aegean Sea. This has to be considered carefully.

i. South Adriatic DW Formation

17 stations are planned north of Otranto Strait with current meters in the Strait (cf. section general survey and strait measurements) and an additional 15 stations south of the Strait of Otranto. This will be under responsibility of an Italian ship. (Box A - Fig. 3b)

ii. South Aegean Sea DW Formation

30 stations (as already mentioned) will be undertaken in a (100 x 100 km square located between Cyclades and Crete (Box B - Fig. 3b) and 8 current meter moorings with 2 or 3 current-meters (depending on depth) should be maintained for a one-year period, east and west of Crete (cf. straits measurements). This will be under responsibility of a Greek ship.

3.4 SURFACE AND BOUNDARY PROCESSES

3.4.1) PROGRAM FOR STRAITS

To obtain a quantitative estimate of water exchange through the straits connecting the Eastern Mediterranean with the adjacent seas, the following monitoring program will be performed. (Fig. 4)

Sicily Strait (Italy):

Three moorings, each instrumented with four current meters, will be placed across the strait for six months starting in October 1985. (Section A - Fig. 4)

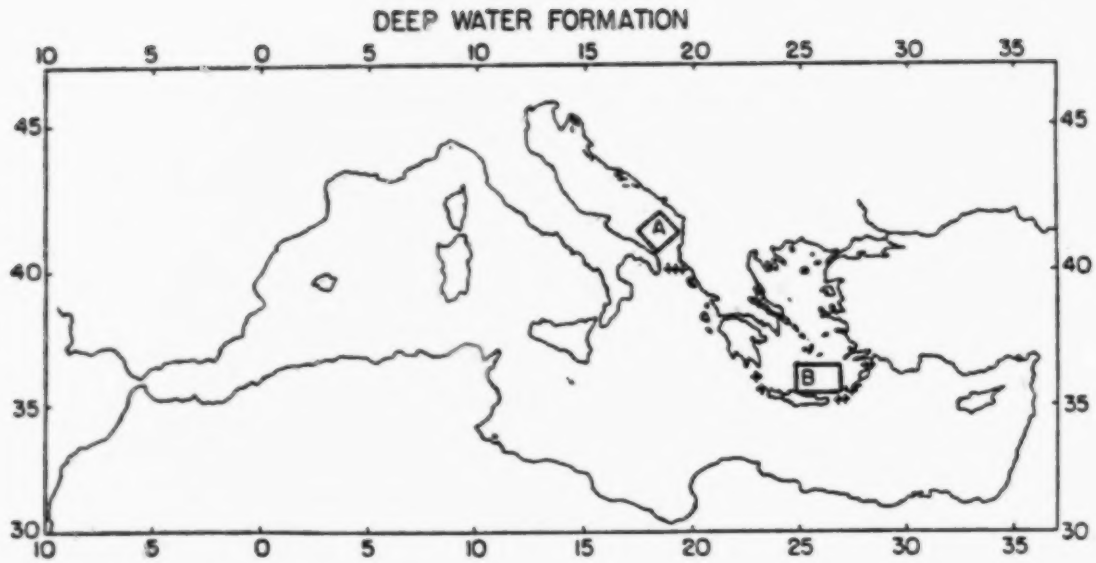
Otranto Strait (Italy):

Three moorings with seven current meters in total, will be positioned for 6 months starting in October 1986 (Section B - Fig. 4).

Aegean Straits (Greece):

Eight moorings, with a total of 24 current meters will be positioned at five straits for four periods within a year starting in October 1985 (Section C - Fig. 4) (1.5 months every season)

Sampling interval = 15/20 min.
Instruments required: 57 + 20 current meters (in total)
14 + 4 acoustic releases
Ship time (in addition to general hydrographic survey).



A, B Intensive studies during winter.
+ Currentmeter moorings.

FIG. 3b

FIG. (3B)

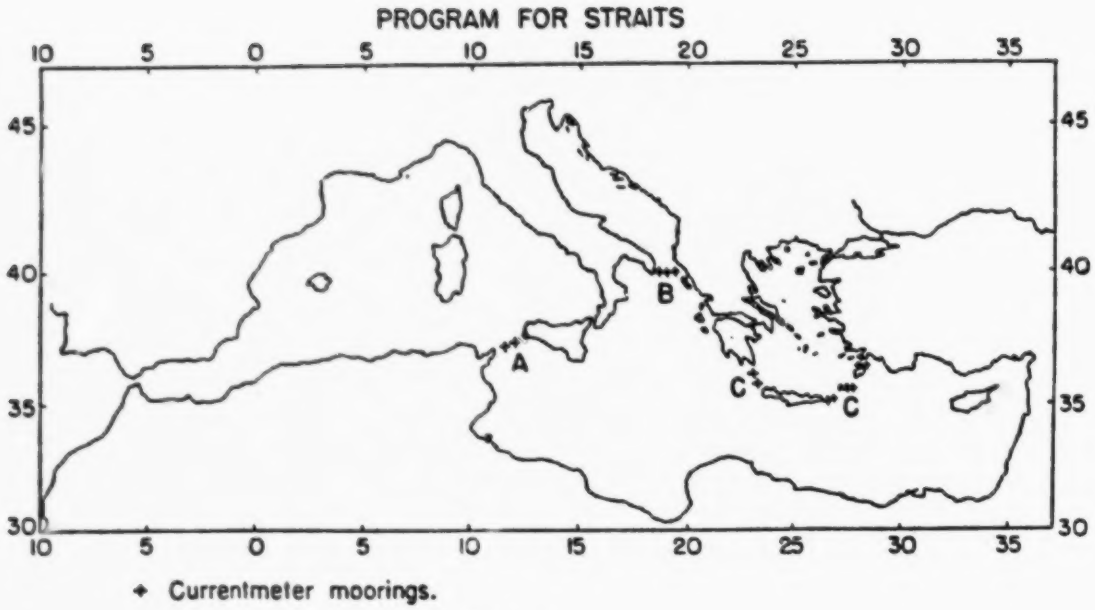

PROGRAM FOR STRAITS
10 5 0 5 10 15 20 25 30 35
45
40
35
30
A
B
C
C
Currentmeter moorings.

FIG. 4

FIG. (4)

3.4.2 REMOTE SENSING

The following parameters can be measured:

- SST (and possibly extended to the visible channels);
- one dimensional wind stress (30 km of space resolution);
- one dimensional surface current (with an accuracy of 10 cm/s)

It is necessary to define the participants of each country to this part of the program.

3.4.3 METEOROLOGY

The importance of knowing the meteorological forcing as input to the modelling effort must be stressed. Thus, it is essential to have available the standard meteorological parameters (atmospheric pressure, wind, air temperature) measured at the international meteorological stations, distributed along the coastlines of the Eastern Mediterranean, in the various countries participating in POEM. Every effort should be made to collect routine observations from land stations and ships together with relevant imagery from satellites. Special observations will be required from the research ships involved; from especially instrumented moored buoys and, so far as possible, from meteorological research aircrafts. In particular, it would be desirable to make finalized experiments in limited areas to study the coupled evolution of the planetary boundary layer and the mixed layer. These experiments would allow us to understand the basic mechanisms determining the evolution of the marine surface layer as well as to parameterize the thermodynamical processes in the dynamical models of the circulation. For the above questions and others, evaporation, sensible and latent heat fluxes should be also evaluated. Particular attention will be paid to the needs of modellers for input and verification data.

3.4.4) TIDE GAUGES

It is recommended that Member States activate and improve the network of sea level gauges in the Eastern Mediterranean in order to achieve a good data set to utilize for the various oceanographic studies. In particular, tide gauges should be installed at the sides of main straits during current meter measurements.

Furthermore, consideration should be given to the use of deep sea gauges if available. It is necessary to have a list of the existing tide gauge stations, and their working condition and responsibilities

3.5 BIOLOGY AND CHEMISTRY

Possible relevant parameter to be measured are: dissolved O_2, pH, nutrients (NO_2, NO_3, NH_3, PO_4, SiO_4) total alkalinity, chlorophyll. However, final decision on parameter sampling will be taken in consultation with concerned Mediterranean scientists during a specialized panel discussion on this topic within the POEM Workshop, to be held in Lucerne in October 1984 during the ICSEM Congress.

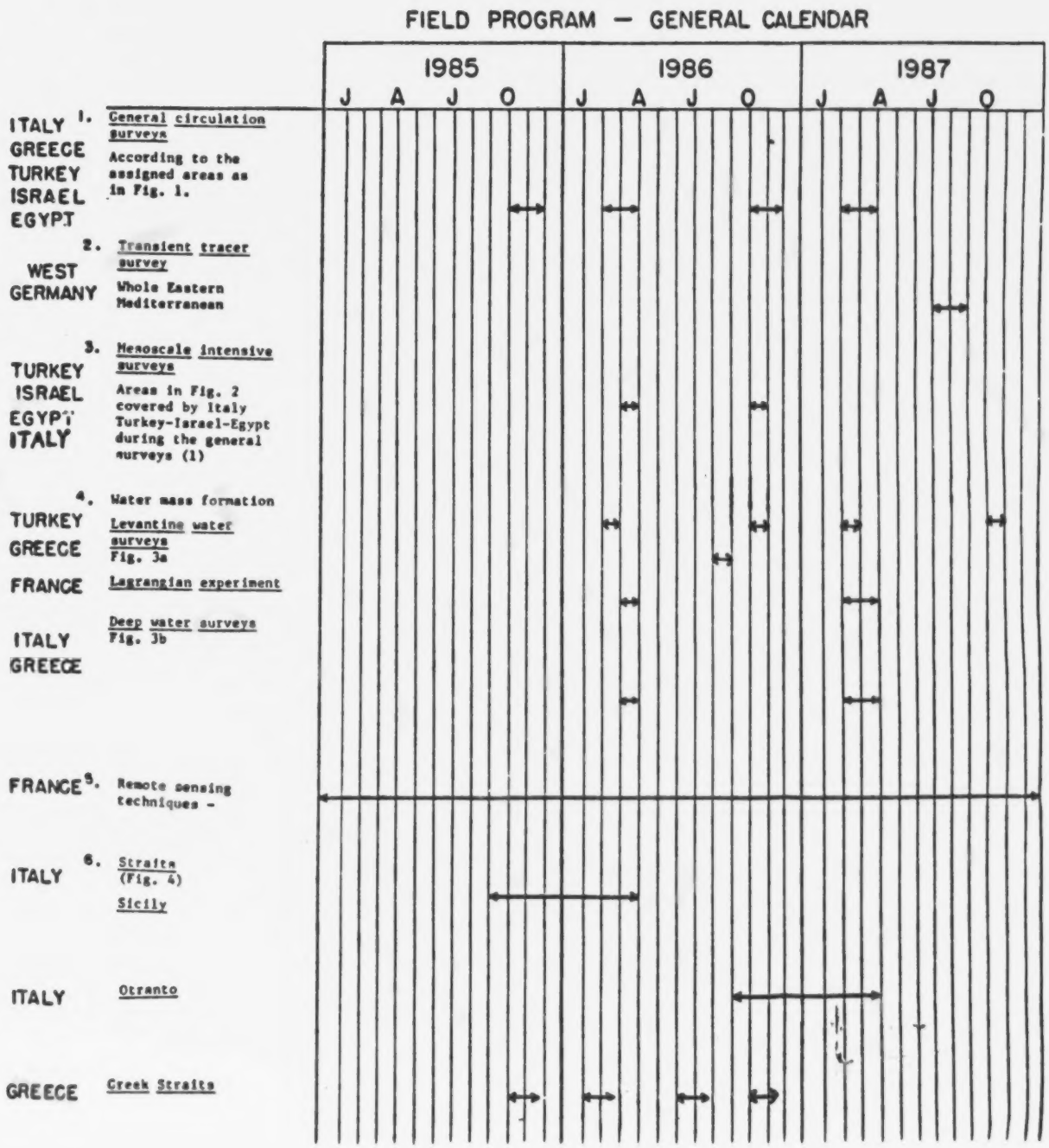
3.6 OVERALL CALENDAR

An overall calendar is given in the following Table (1).

TABLE (1) - FIELD PROGRAM

GENERAL CALENDAR

FIELD PROGRAM — GENERAL CALENDAR



4. DATA MANAGEMENT

4.1 HISTORICAL DATA

The Bureau National de Donnees Oceanographiques, Centre Oceanographique de Bretagne, Brest, has acquired all available historical data and made evaluations of its validity.

In very general terms, the criterion for validating the data was to eliminate everything leading to more than a 0.02 inversion in sigma-theta on the vertical. It appeared difficult in the first attempt to apply this criterion systematically, using some classical method like the Fergusson method. Indeed such an automatic data processing rubbed out strong gradient layers like the Atlantic-Mediterranean interface. So most of the validation was made by hand.

Additional data is acquired all the time and laboratories are requested to send in everything which eventually will be made available to the interested institutions. At the POEM Workshop in Lucerne, in October 1984, the methodology for validating the data will be presented in detail.

4.2 DATA MANAGEMENT AND EXCHANGE

Data acquired through the present research program will be limited for the use of the generator for the period of one year after the completion of the preliminary analysis but not in excess of two years after acquisition. Sympathetic attention will be given by the organizing committee to protect the needs of students in the process of writing their thesis. Efforts will be made to supply the Harvard Dynamic Modelling Centre (section 5) with the data they need at the earliest possible moment on the understanding that the data will be used solely for their particular needs.

The preliminary analysis of data will be carried out with agreed algorithms common to the entire group and data will be stored and exchanged in internationally accepted formats.

5. MODELLING

5.1 MODELLING CENTER FOR THE EASTERN MEDITERRANEAN

The main modelling effort will be concentrated in the USA with the establishment of a Center for the Modelling of the Eastern Mediterranean at the Harvard University, Geophysical Fluid Dynamics Group. All the available, existing models, suitable for application to the Eastern Mediterranean are or will be brought to the Center and there used by the cooperating scientists to investigate different aspects of the Mediterranean circulation and process studies in a comparative way. The Harvard Modelling group will be open to the active collaboration with all the interested and qualified scientists from the different countries participating in POEM. It is intended to serve both an educational as well as research functions. It is also expected that regional models can be developed by responsible groups of scientists in participating countries.

5.2 THE MODELS

The models to be used at the Harvard Center are:

General Circulation Models (GCM):

Primitive Equation Model (USA-Harvard)
Coupled Atlantic-Mediterranean (USA-Harvard)
Inverse Methodologies (USA-MIT)

Multi-Level Model with Active Thermodynamics (Italy-Venice)

Mesoscale Dynamics Water Mass Formation, Mixing and Spreading:

Open Ocean, Quasigeostrophic Eddy Resolving, Multi-Layer Model Coupled with Surface Mixed Layer Model (USA-Harvard)
Surface Mixed Layer Model (USA-Harvard)

The various models require different amounts of computer power. Many of them can be used on small computers in an efficient and relevant way. The model software will be transferred from the Harvard Center to all the cooperating Institutions to be used in their respective countries, on their local computers.

The main scientific objectives to be fulfilled by the modelling efforts are:

a) Determination of the relative contributions to the general circulation and T/S structure evolution by the following driving forces:
   - wind stress
   - thermohaline fluxes
   - source-sink distribution
   - forcing through straits
b) Determination of the general circulation of the Eastern Mediterranean and of its seasonal and interannual variations.
c) Modelling of basic dynamic/thermodynamic processes and mesoscale

variability in regions of strong internal dynamic activity

d) Modelling of deep convection, mixing processes in regions of water mass formation
e) Modeling of water masses dispersion (mixing and spreading)
f) Modeling of the upper layer thermal structure and of its variabilities for different time scales (diurnal-synoptic-seasonal, annual and interannual).

5.3 METHODOLOGY

The methodology of the modeling effort will capitalize upon the most modern and sophisticated techniques for the use of models in an interactive way with data. This involves the use of the most advanced methods for objective analysis of data and the incorporation of data into the models. The methods for data initialization, assimilation and updating will play the central role in the coupling of the experimental (field plan) and modeling efforts. Hydrographic, meteorological current-meter and tracer data will be introduced and used in the above models at successive stages.

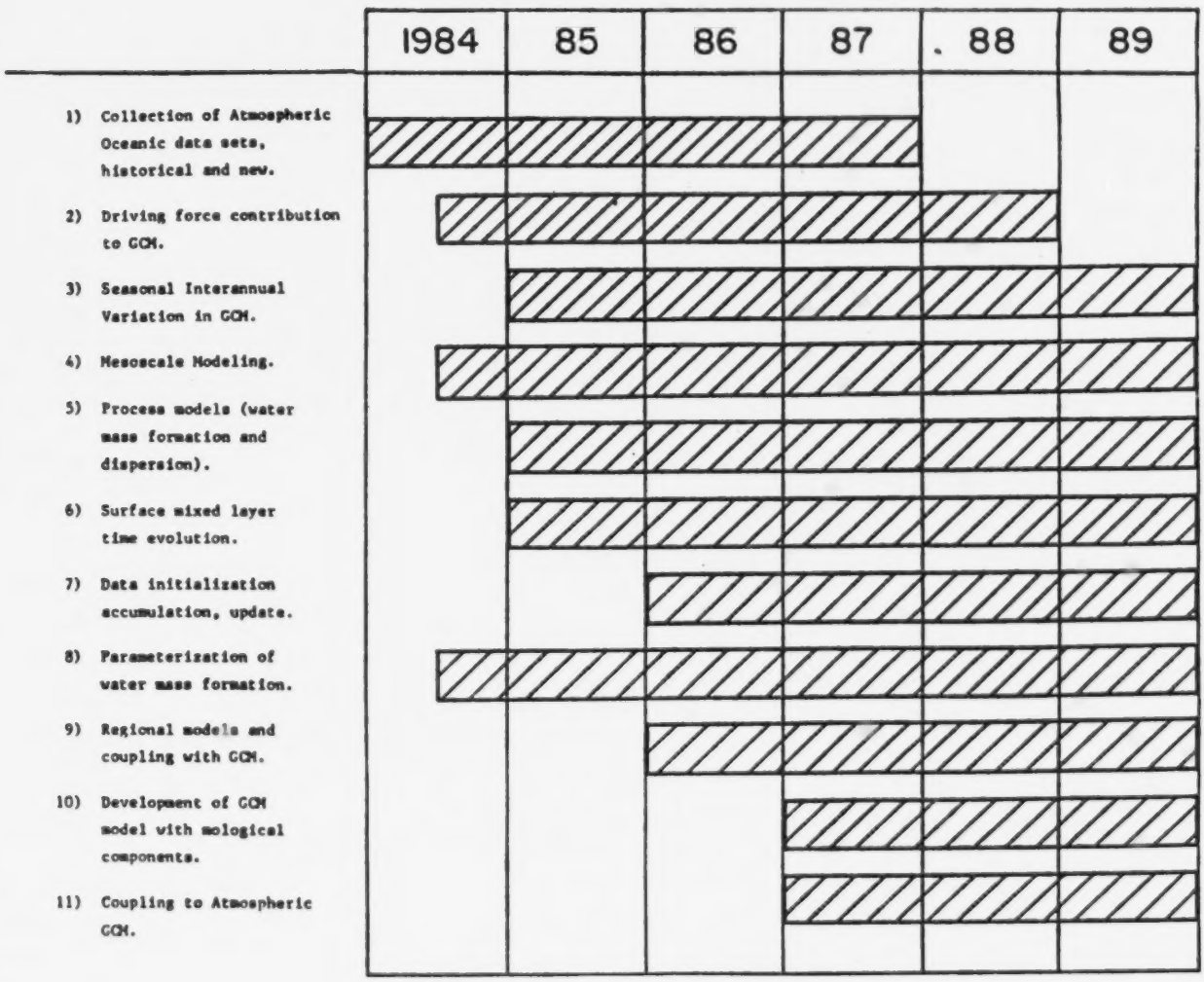
The ultimate goal of the Modelling Program is the construction of a GENERAL CIRCULATION MODEL OF THE EASTERN MEDITERRANEAN adequate for biological and chemical transport processes; its coupling with an atmospheric GENERAL CIRCULATION MODEL for the study of feedback mechanisms and climate studies.

A parallel effort will be the coupling of the Eastern Mediterranean General Circulation model with high resolution models of shelf circulation and coastal areas, of specific interest to and within individual national programs of these nations themselves as desired and possible.

5.4 OVERALL CALENDAR

The overall calendar for modelling activities is given in Table (2) below.

TABLE 2 - OVERALL CALENDAR
FOR MODELLING ACTIVITIES


1984
85
86
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88
89
1) Collection of Atmospheric Oceanic data sets, historical and new.
2) Driving force contribution to GCM.
3) Seasonal Interannual Variation in GCM.
4) Mesoscale Modeling.
5) Process models (water mass formation and dispersion).
6) Surface mixed layer time evolution.
7) Data initialization accumulation, update.
8) Parameterization of water mass formation.
9) Regional models and coupling with GCM.
10) Development of GCM model with mological components.
11) Coupling to Atmospheric GCM.

6. SUMMARY OF PROGRAM

The purpose of the Eastern Mediterranean program is to reach the ultimate knowledge of its phenomenology; to understand the dynamics, variability and energetics of its general circulation; to explain fundamental physical processes like deep convection and water mass formation there occurring and common to different areas of the world ocean. Thus the program has three major components: a) general circulation; b) mesoscale dynamics; c) water mass formation and dispersion.

The ultimate scientific goal is to construct a General Circulation Model of the Eastern Mediterranean adequate for biological and chemical transport processes. The model will thus be applicable to investigate the implications of the circulation for the distribution of biochemical parameters, with consequent fundamental practical implications. This will bring the Eastern Mediterranean from being a very poorly explored area to one of the best known regions of the world ocean. This will also bring the regional institutions and scientists to the forefront activity of oceanographic science and will help to establish long lasting colleague relationships. It will also promote the process of technology transfer and marine scientific knowledge exchange amongst scientists working in the same region.

The scientific effort in exploring the Eastern Mediterranean is discussed in detail both for what concerns the envisioned field plan (section 3) and the modeling effort (section 5).

To be successful the program needs actual resources both from each participating country and from international organizations; institutional arrangements including training and exchange visits of cooperating scientists, scientific coordination and management.

Meetings and workshops are necessary for the progressive updating of scientific knowledge and exchange of information among the participating scientists. Thus, it is highly desirable to hold:

- one yearly workshop
- one yearly intensive meeting of the Organizing Committee of the Program

It is also important to communicate more broadly throughout the oceanographic community interested both in the Mediterranean and in the fundamental processes. Thus the intention is to hold every other yearly workshop in conjunction with an appropriate major scientific meeting arranged by an international scientific society.

The necessity is felt of establishing Scientific Centers for the intensive studies of specific components of the Program. A Modeling Center is being established at the Harvard University, Cambridge, USA, where all dynamical models relevant to the investigation of the Eastern Mediterranean will be gathered, applied, intercompared and subsequently shared. It is desirable to consider the possibility of establishing future necessary Centers such as a) Intercalibration Center, b) Data bank.

P.O.E.M organizing scientists prepared and presented a Round-Table discussion at the ICSEM XXVIII Congress Plenary Assembly, Cannes, France, 1982 and

will present their substantial progress at the ICSEM XXIX Congress and Plenary Assembly, to be held in Lucerne, Switzerland, October 1984.

In the international audience, UNESCO has recognized the importance and strength of the Program by supporting participation of Eastern Mediterranean Scientists at a workshop in Lerici, La Spezia, Italy, September 1983, during which the substantial scientific plan was created. This plan has been published as UNESCO Reports in Marine Sciences No. 30.

The Organizing Committee, with the support of UNESCO and the US National Science Foundation, had an executive meeting in Paris in August 1984. UNESCO plans to continue to support the organizational aspects of the Program; the attendance to meetings and workshops of the cooperating scientists from developing countries; the publication and distribution of scientific documents. However, the requirements for the Program management and its successful execution make it highly desirable that additional International Organizations, and possibly bi or multi-lateral collaborations, play an important role in the support of the Program, under the four main heads; a) Management, b) International Structure, c) Resources and d) Education and Training.

The participation by other interested scientists from other nations within the framework of the scientific program, its objectives and goals is welcome. Such participation could enhance the scientific and general results of the program. The ground rules for such participation are simple:

- the scientific integrity of the program will be maintained
- the free exchange of data between all participants is essential
- the scientific activities including meetings will be carried out in such a way that all participating scientists are included in all activities.

APPENDIX - 1.

DESCRIPTION OF RELEVANT NATIONAL PROGRAMS BY PARTICIPATING SCIENTISTS

(I) EGYPT

The oceanographic scientific community in Egypt is comprised of two main bodies fully engaged with marine science teaching and research. These are:

1. The Institute of Oceanography and Fisheries (IOF) of the Academy of Scientific Research and Technology. The main objectives of this Institute are to carry out basic and applied research for the conservation and development of marine resources, particularly fisheries. The Institute also supervises and cooperates with various national government departments in collecting hydrographic data and fishery statistics and offers technical advice to these government bodies on various technical aspects within its sphere of competence, both in the fields of oceanography and fisheries.

2. The Oceanography Department, Faculty of Science, University of Alexandria. The Department is teaching marine sciences. It graduates junior oceanographers with B.Sc. degree in oceanography after studying basic sciences at the Faculty of Science. It also offers courses for the Diploma of Higher Studies, the Masters of Science and the Ph.D. Degrees in Oceanography. Research work in the various marine science disciplines is also carried out by the department in the Egyptian waters.

Facilities and manpower

At present, neither of the two institutions possesses a research vessel capable of carrying out research cruises in the Eastern Mediterranean beyond the coastal water strip. However, there is the possibility of carrying out some oceanographic cruises on locally hired ships if funding resources are made available. There are several well trained and experienced oceanographers who are able to conduct such cruises and contribute to the research program of the Eastern Mediterranean in cooperation with scientists from neighboring countries. In particular, in the field of physical oceanography, there are at present 5 Ph.D.'s, 8 M.Sc.'s and about 12 B.Sc.'s working at the above two institutions: the Institute on Oceanography and Fisheries in Alexandria and the Oceanography Department of Alexandria University.

Some physical oceanographic equipments are available, but for the purpose of carrying out a research program on the scale we are concerned with here, this equipment will not be enough, nor will it be adequate for the quality criteria identified by the program. A national oceanographic data centre is also available at the IOF in Alexandria.

Activities

In spite of the limited facilities, the above two groups of Egyptian scientists at the above institutions have been active for many years in both pure and applied research. They carried out several hydrographic surveys in national coastal as well as offshore waters and contributed to the study of specific problems of national interest and economic importance.

Funding

Limited funds are available for conducting oceanographic research. These funds are funneled to the oceanographic community through national agreements and/or bilateral agreements with other countries. Several activities in marine sciences with specific objectives were carried out with the assistance of various international organizations such as: UNESCO, IOC, FAO, UNDP and UNEP. These supported activities are implemented within the framework of a well-defined project approved by both the Egyptian Government and the supporting organization.

Fiscal Year: Starts in July.

National Coordination

Oceanographic activities at the national level are carried out through bilateral agreements between the two Egyptian oceanographic institutions mentioned earlier and/or with one or both of them and another national or international institution or organization. However, it is to be noted that other institutions and universities in Egypt have also become increasingly interested in various aspects of marine science, and could therefore be integrated, as appropriate, in activities in the Eastern Mediterranean to be carried out jointly by the two main oceanographic bodies mentioned above

(II) FRANCE

Our main interest in contributing to the Eastern Mediterranean research program is to study specifically the essential processes leading to the ultimate transformation of surface Atlantic waters in subsurface Levantine waters. To our opinion, this involves substantial progress in our understanding of the mesoscale phenomena occuring in the region between Rhodes and Cyprus and in particular of the connections and feedback between these phenomena and larger scale circulation in this area. The crucial point is to establish firmly the basic state which characterizes the preconditioning phase before water mass formation triggering mechanisms could occur.

Our contributions will be according to fundings.

1) Lagrangian experiments :
   a) surface floats located via ARGOS. These drifters could be deployed from every ships. They transmit sea surface temperature and serve as ground truth for SST and help in mapping surface currents
   b) underwater floats (mesoscale purposes) located in acoustic-like SOFAR floats.
   c) pop-up floats located via ARGOS when surfacing. They will be used for spreading and mixing studies in conjunction with TTO.

2) Remote Sensing
   a) classical SST (Lannion-Toulouse)
   b) and possibly visible (CZCS)
   c) scatterometers (ionospheric radar) : this instrument gives information about surface winds and currents

3) Data Management: reduction and assimilation of national data bank in Brest (France) B.N.D.O. Objective analysis and modelling (analytical and numerical)

4) Biochemistry and geochemistry for nutrients and TTO.

5) Assistance for intercalibration and deep sea moorings (long-term).

National organizations which could support this program are:

- Centre National de la Recherche Scientifique CNRS (Programme Interdiciplinaire de Recherches Oceanographique PIRO)
- Centre National d'Etudes Spatiales (TOULOUSE)
- Centre National de Recherche Meteorologique (CNRM) LANNION
- Centre National pour l'exploration de oceans (CNEXO)

A crucial point for french participation will be

a) consideration of Eastern Mediterranean program in the context of implication of water-mass transformation in the general circulation of the ocean (thermohaline component) which is one of the main topics of WOCE.
b) consideration of this program in climate studies (regional: cyclogenesis or/and worldwide: WCRP)

Critical decisions on these points will occur during next fall (1986). Four different groups in France can participate to that program. Namely, the Physical Oceanographic Laboratory in PARIS, remote sensing in PARIS - LANNION and TOULOUSE, biochemistry in MARSEILLE and VILLEFRANCHE.

(III) FEDERAL REPUBLIC OF GERMANY

The Heidelberg ocean tracer group expects to contribute to the programme measurements of the transient tracers tritium, ^{3}He, and freons including an evaluation of these data, also in cooperation with the Harvard modelling centre. In an effort to bring in an FRG ship, the new 'Meteor' has preliminarily scheduled to work in the Eastern Mediterranean for about a month during July-August 1987. This cruise is to contribute the bulk of the large-scale transient tracer survey, covering most of the Eastern Mediterranean, with a fairly coarse grid of stations. Other FRG groups have expressed interest to do measurement of nutrients, trace metals, certain pollution parameters on this cruise. An FRG biological component is also possible while participation of an FRG CTD group is open at the present time. As the new 'Meteor' will be a comparably large ship, further projects that have a large-scale aspect would be welcome. It is for example considered to arrange for the measurement of CO_2 parameters.

Requirements of Tracer Field Work

The tracer work has different components:

1) Deep-water spreading and renewal;
2) Deep-water formation including formation rates;
3) Intermediate water formation and spreading

Accordingly, the required field program has the components:

1) Large-scale survey. The general station spacing should be 2° X 2° and about 24 samples per station would be required (depending on water depth);

2) Special smaller scale surveys in the pertinent formation and transformation areas (1), i.e.:
   i) Southern Adriatic and Otranto Strait;
   ii) western slope between Otranto Strait and Malta Sill;
   iii) Strait of Sicily;
   iv) Aegean sea and Aegean outflows and possible
   v) Dardanelles
   vi) deep sills between Ionian and Levantine basins.

The station positioning would be mainly dictated by bottom topography and would be quite variable; also, it should at least partly be done more than once, and a good part of the related sampling would be on ships other than the 'Meteor'. Tritium and 3HE sampling could be done virtually on any ship, preferably by Rosette/CTD equipment. Freons, however, need larger than usual and specially checked sampling bottles. Also, because the measurements are to be done aboard ship, the work has to be concentrated to no more than very few expeditions. Of special interest would be the Italian survey between the Adriatic and the Strait of Sicily.

3) LIW formation and spreading; mostly 3He and tritium are used, casts to no more that 500m depth, station spacing 1° x 1° or denser. This program would have to be coordinated with the proposed French efforts of observing the early spreading by Lagrangian buoys.

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(1) Nota: Subject to the approval of the interested governments.

Also required is repeated observations which could well be accomplished by means of the regional, e.g. the Turkish cruises.

One of the aspects of the tracer program will be to develop the best way of data evaluation. This is envisaged to be done first by means of kinematic multi-box models, but we are very much interested to work with the Harvard Centre to explore the more sophisticated model for that purpose. One should also try to use the models in an interactive way, i.e. trying to use the tracer data to improve certain parts of the parameterization of the models, in particular from the point of view of the water formation processes, as well as of large-scale mixing.

(IV) GREECE

1. National Oceanographic Programs

a. Long term oceanographic projects of general scientific interests, concerning physical, chemical, biological and geological aspects.

Seasonal or/and monthly cruises are carried out in greek seas (Aegean and Ionian). Responsible research centers for the above projects are mainly the Institute of Oceanographic and Fisheries Research (IOKAE) and the Hellenic Hydrographic-Oceanographic Servece.

b. Intensive studies of special interests.

These research projects concerning coastal areas of the mainland and islands are carried out to cover National requirements such as underwater construction, installations of sewage outfalls, pollution studies etc. In conjunction with the above mentioned main national services, other relevant agencies as the Ministries of Environment and Merchant Marine, as well as Research Institutes (Democritos Nuclar Center, etc) and large number of laboratories of Greek Universities are participating and collaborating in the above projects.

In the framework of the above mentioned activities the following parameters are measured. Temperature, salinity, Diss. oxygen, PH, Nutrient (Phosphate, Nitrate, Nitrite, Silicate, Ammonia) trace elements, currents, tides, sea-state and other conditions, phyto and zoo plankton, phyto and zoo benthos, (quantitative and qualitative studies), hydrocarbons, sediments etc.

The data, after processing and analysis, are presented in technical reports and distributed to relevant national agencies and institutes. They are also used by scientists for publications and communications.

The storage of the total amount of data in a national data bank is under consideration.

The complete coverage in Meteorological parameters is under the responsibility of the Hellenic Meteorological Service. We notice that satellite imagery is used, in addition to the standard oceanographic measurements.

The establishment of a center for receiving and processing satellite data is under consideration. Efforts in modelling are made in various laboratories of the Research Centers and Technical Universities.

2. Infrastructure

a. Oceanographic vessels
For the open sea longterm project, two well-equipped oceanographic vessels, (50-65 m long) are used.

Two smaller reconstructed vessels are used in the shallow coastal areas projects. We estimate that in 1985 two new very well equipped oceanographic vessels of 50 and 25 m respectively, which are presently under construction, will be ready.

b. Instrumentation

The following instruments and facilities are available for the execution of the research work:

- currentmeters (Anderaa, Interocean)
- Acoustic releasers (AMF, Interocean)
- CSTD (Interocean, Neil Brown)
- Sampling bottles and reversing thermometers
- Tide gages (AOT, Stevens)
- Technikon Autoanalyser
- Salinometers (Autosal, Beckman, Tsouroumi)
- Well equipped laboratories for chemical, biological and geological research work.

Mini and larger computers are available in all research centers and ministries involved.

c. Manpower

More than 50 scientists, involved in Oceanography, are working in the different research centers and agencies and more than 10 of them are physical oceanographers. There is also a relevant number of technicians, programmers, analysts, etc.

3. International Activities

Greece is participating in the MEDPOL (Phase-B) programme.

There is a signed agreement between the governments of Greece and Italy for scientific cooperation, which includes Oceanographic research in the Ionian sea.

4. Comments on the EASTMED Programme

A small scientific group is working on the proposal for the Eastern Mediterranean Cooperative program, in order to estimate its requirements in conjunction with the capabilities of undertaking part of this effort.

Great interest has been expressed by the scientific community in the East Med program.

The various national centers will examine the possibilities of incorporating the activities of the EASTMED program into their projects concerning the areas of south Aegean and Aegean Straits.

After the above procedures, a final proposal has to be submitted to the Ministry of Research and Technology for financial support and management.

The Institute of Oceanographic and Fisheries Research is considered to be the coordinating and responsible national centre, if the Greek contribution to this program is decided upon.

In the framework of the EASTMED program, cooperation with French and German Laboratories is being considered for specific aspects and requirements such as transient tracers and floats, and remote sensing.

(V) ISRAEL

In Israel, the only institution dedicated to oceanography and engaged in all aspects of oceanographic research is the Israel Oceanographic and Limnological Research Ltd. (IORL) which is a company whose shares are the property of the Israeli Government and its activities are controlled by the Israel Ministry of Energy and Infrastruture. Additional oceanographic research is being carried out at other institutions such as the Geological Survey of Israel, the Weizmann Institute of Science, the Hebrew University, the Tel Aviv University, the Beer Sheba University, the Technion and some more.

The IOLR has some 50 scientists in three laboratories: the main one in Haifa, the Yigal Allon Kinneret Limnological Laboratory, near Iberias, engaged mainly in limnology and the National Center of Mariculture, in Elat, engaged mainly in mariculture. The IOLR operates the only deep sea oceanographic vessel in Israel the R.V. SHIKMONA which is a 180 ton 28 m long vessel capable of a maximum speed of 10 knots, able to stay at sea for about two weeks and sail anywhere in the Mediterranean Sea. The SHIKMONA needs a crew of 7 and has up to an additional 12 berths for scientists. It is air-conditioned and equipped with the usual communication and navigation equipment including auto pilot, satellite navigation and deep sea precision echo sounder. She has one wet and one dry laboratory, a CTD and a hydro winch (both capable of carrying 5000 m of cable), a 6 ton crane and stern door to facilitate the deployment of buoys. The available power supply includes single phase 220 volt 50 Hz, 220 and 110 volt 60 Hz as well as three phase 220 volt 60 Hz. For the physical oceanography cruises it carries a N.B. CTD with a 12 bottle Niskin rosette and bottom pinger as well as the computer required to exhibit the STD preliminary results in real time. There is sufficient space in both the wet and the dry lab for the additional equipment required by chemists during common cruises.

IOLR works according to a long-term national oceanographic program. The main infrastructure budget comes from governmental sources. In contrast the scientific projects, elaborated by the scientists on the basis of the general master plan, are funded by research contracts obtained by the leading IOLR scientists from various funding sources. Each and every project is funded by a particular sponsor or a number of sponsors and the principal investigator of the project is directly responsible to the sponsors for the provision of the required results. The data is usually the property of the sponsor who is always requested to allow scientific publication and, in our experience, will usually acquiesce to our request but one must emphasize that dissemination of raw data must be carried out in accordance with the sponsors wishes who may restrict it or enforce it according to its own particular policies. Israel's fiscal year begins on the 1st of April and we usually try to work within this frame. Therefore, the most effective policy would be to have any research grant requests from Israeli sources submitted by the end of December, but they should be submitted even earlier to allow for some 'give and take' before their final form. This is particularly true in the case of research grants submitted for funding to more than one sponsor. Applications for research grants can be addressed to a number of sources: The Ministry of Energy and Infrastructure; The National Committee for Research and Development; Various binational funds and agreements, in particular the USA-Israel Binational Fund and AID, both requiring the participation of a USA scientist, all having relatively small budgets for which competition is very high; UNEP, the IOLR contributed to and still has some MEDPOL

projects. In the past we also had two projects sponsored by the ONR (one in the Mediterranean and one in the Red Sea).

The Israel Academy of Sciences and Humanities does not support research financially. It supports various national scientific organizations and it maintains the formal and official connections with international scientific organization such as SCOR (Dr. Hecht is at present one of the four Israel's representatives at SCOR). The Israel Academy of Sciences and Humanities can land considerable backing, prestige and moral support locally and should be acquainted with a program such as the international effort for the investigation of the Eastern Mediterranean Sea.

The Physical Oceanography Department of the IOLR consists of four scientists and four technicians with additional technical support from other departments (electronics, mechanical workshop, etc.). The four scientists are: one Ph.D. with formal physical oceanography training, two M.Sc. with training in physics and hydrodynamics and one B.Sc. in the process of completing his M.Sc. at the Department for Atmospheric Sciences at the Hebrew University in Jerusalem. There are no facilities for training physical oceanographers in Israel and physical oceanography courses are given only at the level required by geology, chemistry and biology students. Lack of manpower is the main problem facing the department and we look upon a number of students at present in the USA as the potential for improving the situation. Moreover, in the past, we helped some students to continue their education abroad and we will try to do so in the future as well.

At present, the Physical Oceanography Department is engaged in two main projects: 1. The measurement of currents, waves and meteorological parameters in the Dead Sea; 2. The systematic survey of physical oceanographic parameters in the Eastern Levantine Basin. The last project consists of the acquisition of data on the distribution of salinity and temperature versus pressure at some 30 stations distributed on a 0.5° grid between the Eastern Mediterranean sea shores, 34° 30' N and 32° 30' E (stations 7 to 34 in fig. 1). Four such cruises were carried out since 1975 but until now we were allowed to release the data from only the first 7 cruises. Some times those cruises are extended to a longer range (e.g. stations 35 to 54 in fig. 1).

Chemical parameters (O_2, pH, nutrients, etc.) are measured on some of the stations during part of the physical oceanography cruises. Data for biological and geological investigations are acquired during a number of additional, separate cruises. In particular primary productivity investigations are conducted within the framework of a joint program USA-Egypt-Israel which is supported by AID.

(VI) ITALY

Deep sea hydrographic surveys will be carried out with the oceanographic vessel 'Bannock' of the Italian National Research Council (CNR). The vessel is about 60 m long, is well equipped with oceanographic instrumentation and can accomodate up to 16 scientists. Requests for ship time for every calendar year must be sent to CNR within the September month of the previous calendar year (i.e. by Sept. 84 for calendar year 1985). The following research groups have expressed their interest and willingness to participate in the Program:

- Istituto Fisica Atmosfera - CNR - Rome
- Istituto Studio Dinamica Grandi Masse (ISDGM) - CNR - Venice
- Stazione Oceanografica ISDGM - CNR - La Spezia
- Istituto Biologia del Mare - CNR - Venice
- Istituto Sperimentale Talassografico - CNR - Trieste
- Osservatorio Geofisico Sperimentale (OGS) - Trieste

It is highly desirable that other groups join the Program, especially in the meteorological and remote sensing areas.

The equipment capabilities of all Italian groups include: a) CTD probes (Neil Brown) and b) current meters (Aanderaa, NBA, acoustic currentmeters), c) Rosette Nansen bottles, d) chemical biological equipment, e) tide gauges

A calibration center and data bank are already existing and available at the Osservatorio Geofisico Sperimentale of Trieste.

Italy is in the process of formulating a long-range national program for oceanographic research in which the Eastern Mediterranean Program has already been included. The starting date of this National Program is not yet defined. The Committee for Physical Sciences of CNR has already recommended that the Program must be financially supported by CNR. Important interest to the program has been expressed by the Ministry of Scientific Research and the Ministry of Ecology of the Italian government

(VII) TURKEY

There are two institutes of Marine Science in Turkey: The Institute of Marine Science of the Middle East Technical University is located on the southern coast of Turkey at Erdemli. The other is situated on the Agean at Izmir and is attached to the University of 9th September.

The Erdemli Institute carries sponsored research for the government and international agencies (UNEP, IOC, FAO, NATO) and also offers graduate education. At present there are 11 Faculty members and 24 graduate students. A 500 ton research vessel R/V Bilim and two smaller (12 m) vessels are available. R/V Bilim can accomodate up to 14 scientists, she has a crew of 11 and is well equipped with various scientific instruments.

The Institute at Izmir has a research vessel (R/V K. Piri Reis) which is 28 m in length. R/V Piri Reis is also well equipped for deep ocean research.

The marine science institute at Erdemli is relatively well developed in Physical and Chemical Oceanography. Since 1976 Physical Oceanographic research has been mostly concentrated on the shelf areas and mesoscale experiments have been conducted. Modelling efforts attempting to blend judiciously the field work with theory have been a focal point for the faculty of four in marine physics.

Both institutes possess C.T.D. probes, sufficient number of current meters and other physical oceanographic instruments. The Institute at Erdemli is well developed in laboratory facilities.

The Institute of Marine Sciences at Erdemli is strongly committed to deep ocean research in the Eastern Mediterranean. A programme in training and research of modest dimensions has already commenced. If the national priorities permit and if both the national and international support becomes available, the Erdemli Institute will participate in the proposed Eastern Mediterranean programme. Erdemli Institute considers the research programme on the Physical Oceanography of the Eastern Mediterranean most timely and important scientifically.

It is worth pointing our that Turkey is in the process of establishing a long range national programme in oceanographic research. The elements of this programme that are pertinent to the proposed international research on the Physical Oceanography of the Eastern Mediterranean will become clear in the near future.

(VIII) THE USA

Interest among scientists from the United States in research in the Eastern Mediterranean and in participation in the POEM Program is strong and substantial. It includes research via in situ field experiments, theory and modelling, and remotely sensed data directed towards: the physics of water mass formation, dispersion and mixing, processes and their parameterizations; mesoscale and general circulation modelling; data assimilation; and the effects of physical transports on biological and chemical processes.

The system for funding scientific projects and programs in the United States involves proposals for scientific research which are presented to federal government funding agencies for consideration by program managers and generally subject to peer review by the scientific community. Interested scientists for various institutions often coordinate proposal submission in order to carry out a cooperative research program. Funding commitments can be made for, eg. a three year project. Scientific quality, importance, timeliness and feasibility are important factors governing funding decisions.

Several scientists from the United States have already participated in developing and planning the POEM program, and the co-chairpersons have received travel support for their participation in this process. Scientific proposals are under preparation or planned. It is intended to establish the POEM modelling center at Harvard University with active participation by Harvard and MIT Scientists as well as visiting scientists for several other institutes participating in the program. Some funds will be sought in the US for general program administration. To date, scientists from the Brookhaven National Laboratory, Colombia University, Harvard University, the Naval Oceanographic Research on the Development Agency, Massachusetts Institute of Technology and the Woods Hole Oceanographic Institution have expressed their interest in or intention to participate in POEM.

IX. CYPRUS (Added by request on 17.x.84)

Representing my country to the Bureau of the 29th ICESM Congress and because of our interest in POEM, I would like to express our interest to participate in and support this effort.

I would also like to inform you of our activities and research capabilities in the field of oceanography.

We do have the scientific and technical personnel as well as the required instruments and laboratory facilities to carry out basic oceanographic research. Using these facilities we work and implement national programmes of oceanographic research, mainly in coastal areas. Our programme includes T, S, O_2 and nutrient measurements as well as current measurements.

In addition, I would like to mention our collaboration and contribution in International projects such as the MED POL.

My personal interest in the Eastern Mediterranean Project will be transferred to my colleagues in Cyprus and I believe that our proposal for collaboration and contribution will be adopted and supported by the Cyprus Government and be able to cover a reasonable area.

Our final position concerning our participation and contribution will be expressed after consultations with my Government.

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APPENDIX 2

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Unesco, Paris, 7-9 August, 1984

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October 1984

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PART II

WORKSHOP ON

PHYSICAL OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN (POEM)

A DISCUSSION MEETING
LUCERNE, SWITZERLAND, 16 OCTOBER 1984

WORKSHOP ON PHYSICAL OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN (POEM)

A DISCUSSION MEETING

Lucerne, Switzerland, 16 October 1984

A one-day workshop on Physical Oceanography of the Eastern Mediterranean was held on 16 October 1984. The main objective of the Workshop was to discuss further the scientific aspects of the proposed programme among a broad base of scientists generally interested in the problem. POEM aims mainly at the scientific exploration of the physical processes occurring in the Eastern Mediterranean and the investigation of important related phenomena, through concerted observational and modelling efforts, which will ultimately lead to a better and permanent dynamic understanding of the region. Relevant aspects of coordination and management of the POEM Programme were also considered by the Workshop.

The workshop was attended by about 100 participants from 14 countries: Cyprus, Egypt, France, Federal Republic of Germany, Greece, Israel, Italy, Lebanon, Romania, Spain, Turkey, United Kingdom, United States, and Yugoslavia, and two international organizations: UNESCO and IOC (Appendix II). It was held in conjunction with the Physical Oceanography Committee within the XXIX Congress and Plenary Assembly of the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM), in order to take this opportunity to communicate with a broad base of international colleagues with communal interests.

The substantial scientific basis of the POEM Programme as developed during the last two years, has been published as UNESCO Reports in Marine Science No. 30, entitled: "Physical Oceanography of the Eastern Mediterranean: An Overview and Research Plan", Report of the Workshop held in Lerici, Italy, September 1983. This report was made available and distributed to the participants.

The Organizing Committee of the POEM Programme held a meeting in Paris from 7 to 9 August 1984. This meeting prepared the agenda and provided the background for the workshop discussion meeting in Lucerne.

The workshop consisted of two working sessions, the first was devoted to brief scientific presentations by scientists from the Eastern Mediterranean region or working in the region, with special reference to the POEM Programme, its plan and objectives. The second session was a round-table panel discussion dealing with the various aspects of the programme.

After the introduction of the Agenda of the Workshop (Appendix I) by Prof. Allan R. Robinson (Co-chairman of the POEM Programme), Dr. Selim Morcos, UNESCO representative, welcomed the participants and outlined the interests of both UNESCO and the IOC in the development of this programme, and stressed the scientific importance of the programme presently being prepared and planned by a group of eminent scientists interested in the subject. He further explained that such an exciting scientific programme would certainly need a concerted effort from both the international community and the respective national authorities of the Eastern Mediterranean countries and, of course, from the individual scientists involved.

Next an overall presentation of the POEM Programme by the Co-chairpersons, Prof. Allan R. Robinson and Prof. Paola Malanotte-Rizzoli was made, followed by a series of brief scientific presentations by 12 scientists. These short presentations mainly provided reviews of specific regions of the Eastern Mediterranean, new results and information relevant to the various physical processes occuring in the Eastern Mediterranean: phenomenology and kinematics, general circulation, mesoscale dynamics, water mass formation and dispersion, air-sea interaction, and on the remote sensing application to the Eastern Mediterranean (see Agenda). In the following, a brief account is given on each of these scientific presentations:

1. Phenomenology and Kinematics

a) In the southern basin:

In the southern basin of the Eastern Mediterranean, several data sets of hydrographic and current measurements have been made available for scientific study. These data sets were reviewed by Artur Hecht and have already been used for preliminary modelling by the Harvard Modelling Group.

b) In the northern basin:

The data collected in the northern basin of the Eastern Mediterranean during a mesoscale sampling survey in a very large region of the basin, were reviewed by Umit Unluata who outlined the main features of water structure and phenomenology in this region.

2. General Circulation

The general circulation properties of the whole Mediterranean basin were briefly reviewed by Paola Malanotte-Rizzoli. Results were presented of general circulation modelling under conditions of different wind stress, corresponding respectively to winter and summer situations, of forcing through straits, to explore the barotropic component of the general circulation of the Mediterranean.

Ahmad El-Gindy gave a review of recent work on the Eastern Mediterranean in which he established a thorough phenomenological analysis of all the existing data made available for this study by the 'Laboratoire d'Oceanographie Physique' in Paris, which were also used to study the seasonal phenomenology of the Eastern Mediterranean.

3. Mesoscale Dynamics

This topic was presented by Allan Robinson and consisted of two parts: the first was a general introduction to recent knowledge and methods of studying the mesoscale dynamics in other parts of the world oceans. The role of data assimilation and the optimal estimation theory in describing the mesoscale field, both in order to elucidate physical processes and for practical nowcasting and forecasting, were explained. These methods would need new data acquisition in the Mediterranean and should lead to more powerful advances in our knowledge of ocean dynamics. It was mentioned that the physical conditions in the Mediterranean are different from those of other oceans in an interesting way regarding the internal Rossby radius of deformation, which is characterized on the one

hand by being smaller than in the Atlantic or the Pacific, for example, and on the other, by the fact that the -Rossby number (ratio of the relative vorticity to the planetary vorticity advection) is stronger. In the second part of the presentation Robinson reported on some preliminary studies made on Eastern Mediterranean data sets which showed interesting non-linear interaction between scales of motion.

4. Water Mass Formation

This consisted of three parts: First, Jean-Claude Gascard gave a general review of the POEM plan with particular emphasis on localized field studies which will be devoted to the exploration of deep convection phenomena, both on the Levantine Water in the Eastern Mediterranean and the Deep Water in the southern Adriatic and the Ionian Sea.

Second, William Roether presented his new results on transient tracers for which the water mass properties in the deep layers could be followed and traced throughout the whole of the Eastern Mediterranean basin, and showed how these dispersion studies can be related to trace back the origin of formation of the different water masses.

Selim Morcos concluded by presenting some views about the sources of formation of the intermediate water. The fact that the properties of the intermediate water are more heterogeneous in the Levantine Basin as compared to its properties after passing the Strait of Sicily, indicates that the process of Levanting intermediate water formation does not take place in an identical way in time and space. Most notable, was the evidence showing processes of formation in the shelf waters in the southern Levantine, even if not as vigorous and regular as should be expected in the north.

5. Air-Sea Interaction and Remote Sensing

Henry Charnock and Mohsen Osman presented the various aspects of interaction between the atmosphere and the Mediterranean Sea. The importance of knowledge of the atmospheric fluxes and the meteorological forcing was stressed. For this purpose, it was pointed out that relevant meteorological data should be collected during the POEM Programme, and efforts should be made to obtain routine observations from land stations and ships, together with satellite imagery in addition to data from moored buoys and, if possible, from meteorological research aircraft.

The Round-Table Discussion

During the round-table discussion, four topical panels were formed, each dealing with specific aspects of the POEM Programme. Every panelist presented his views and remarks relevant to the panel subject. The following are brief notes on some of the views expressed during the discussion of the respective panels.

1. Biological and Chemical Implications

During this discussion, the development of biology and chemistry was stressed. An attempt was made to identify certain issues so that guidance could be given in the future to the planning process concerning the chemical and

biological components of POEM. Suggested research topics included nutrient cycling and budgeting, primary productivity, plankton surveying. It was agreed that such topics should be given priority to allow to be reaped the maximum benefit from the physical oceanographic programme.

2. Data Banks for the Eastern Mediterranean

The panel discussed the question of having a centre functioning as a Data Centre or a Data Bank for the POEM Programme. It was pointed out that perhaps one single centre would not be able to fulfill all the requirements of an Eastern Mediterranean Data Bank. Y. Treglos, the IOC representative, reminded the panel that in international organizations, particularly in the IOC, there already exists a well-established mechanism for data exchange, and that special data formats have been developed for this purpose. He also informed the panel that most of the Mediterranean data available are stored in one centre of the World Data Centre's network.

Among the local sources of data which can be made available to the POEM Programme are: the BNDO in Brest, France, through the 'Laboratoire d'Oceanographie Physique' in Paris; and the 'Osservatorio Geofisico Sperimentale' in Trieste, Italy.

The necessity for a system of data coordination for the various data collected for the POEM Programme was stressed, so as the exchange of data among the participating scientists is ensured on the basis of free exchange, as common in international organizations.

A lively discussion point was whether or not a dedicated POEM Data Bank was necessary and/or desirable. Several points of view existed on this topic, but the question was not resolved.

3. Methodologies and Techniques

a) Air-sea interaction and meteorology

The importance of using a variety of approaches to obtain this valuable information was stressed: Coordinated data assembled from routine observations were needed, as well as routine shipboard measurements and also scientific studies of the surface flux situation.

b) Hydrographic calibration

Since much of the hydrographic data for POEM will be collected using CTD instruments, it will be essential to define a common procedure and standards of data collection, handling, intercomparison and intercalibration. Several details have to be agreed upon by all scientists participating in data collection. For example, the rate of descent of the CTD instrument, the rate of data acquisition, the calibration with bottles and reversing thermometers, the minimum number of samples to be collected, the exchange of water samples for intercomparison, the parameters to be compared, the method of using the calibration exercise to correct the CTD data, the algorithm to be used for data reduction, etc... these questions should be carefully considered by the Steering Committee during the planning phase of the programme.

c) Deep-sea mooring

The intention of having some deep-sea moorings was discussed and was found desirable. The specifications of such moorings and the objectives of their deployment was presented by M. Gerges, who also stressed the importance of the intercomparison between the various moorings to be mounted in the different regions of the Eastern Mediterranean. It was mentioned that any group of scientists desiring information on methods of deep-sea mooring may contact the representatives from United States, France or the United Kingdom who will be happy to work with them and to arrange for the technology transfer from some of the more advanced groups in this type of work.

d) Remote sensing

Interest was expressed by Paul La Violette for the effective participation of the NORDA-NSTL Station in the POEM Programme. This facility can provide some satellite imagery (AVHRR data) taken by the NOAA satellite. After being atmospherically corrected and converted into absolute sea surface temperature (SST) data, it could be made available to the participants in POEM for further analysis. The frequency of obtaining such remotely sensed data should be determined according to the requirements of the respective field programme components of POEM.

An interesting and detailed presentation was made by Jean Dellue, who described the possibility of using land-based radar measurements in the Eastern Mediterranean, as has been previously used in the Western Mediterranean.

e) Modelling

Two points were discussed: First, the establishment of the Eastern Mediterranean Modelling Centre at Harvard University, which will play an important role in developing the modelling capabilities in the region through an effective collaboration with all the interested scientists from the different countries participating in POEM. The second point was the need for a parallel effort which should be made at the national level so that national groups of modellers may develop their modelling skills. Then, it is hoped that the flow of experience and information between the Harvard Modelling Centre and these national groups will be established and accelerated.

Conclusion

At the end of the workshop, it was generally felt by all the participants, who represented the greater part of the Mediterranean oceanographic community, that it is now timely to launch such a scientific programme of research for the Eastern Mediterranean. It was further stressed that the programme is sufficiently interesting and promising to proceed with formal arrangements of proposals for sponsorship by national and international agencies.

The programme was then considered by the Physical Oceanography Committee of ICSEM who endorsed the general approach to the problems, thanked the Co-chairpersons and the Organizing Committee for their accomplishments during the past two years and acknowledged the Bureau of ICSEM for acting to endorse and encourage the studies during that period. It was further recommended that both UNESCO and IOC be addressed to give support to the programme. A Steering Group

for the POEM Programme was established consisting of scientists from the region and elsewhere, who indicated their intention to participate in the programme (Annex II). The formal recommendation from the Physical Oceanography Committee (POC) (Annex III), read by POC President Jose Gonella, was adopted by the workshop and thereby, the international scientific community of the Mediterranean endorsed the implementation of the POEM Programme.

APPENDIX I

WORKSHOP ON PHYSICAL OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN

(POEM)

Date: 16 October 1984 Place: ICSEM Congress, Lucerne

AGENDA OF THE MEETING

Session 1: Opening and Scientific Presentation

9:00 a.m. - 12:30 p.m.

A.	Welcoming Remarks	S.A. Morcos
B.	Overall Presentation of the Programme	A.R. Robinson & P.M. Rizzoli
C.	Scientific Presentations	
	1. Phenomenology and Kinematics	
	Review, Southern Basin	A. Hecht
	Review, Northern Basin	U. Unluata
	2. General Circulation	
	Important Features	P.M. Rizzoli
	Synopsis of New Results	A. El-Gindy
	3. Mesoscale Dynamics	
	General Presentation	A.R. Robinson
	4. Water Mass Formation and Dispersion	
	General Review & POEM Plan	J.C. Gascard
	New Results	W. Roether
	New Views	S. Morcos
	5. Air-Sea Interaction & Remote Sensing	
	Presentation by:	H. Charnock
		M. Osman
		P. LaViolette
D.	General Discussion	

Session 2: Round Table Discussion

14:00-18:00 p.m.

Panel 1: Biological and Chemical Implications
Chairman: W. Roether
Panelists: Y. Halim, A. Cruzado, N. Dowidar, T. Hopkins, C. Serruya, M. Karydis, N. Friligos

Panel 2: Data Banks for the Eastern Mediterranean
Chairman: J-C. Gascard
Panelists: Y. Treglos, A. Hecht, A. Theocharis, U. Unluata, M. Gacic, A. Michelato

Panel 3: Methodologies and Techniques
Chairman: H. Charnock
Panelists:
Air-Sea Interaction & Meteorology: H. Charnock and M. Osman
Hydrographic Calibrations: A. Hecht, A. Michelato, A. Theocharis
Deep-Sea Moorings: R. Meloni, M. Gerges, A. Laskaratos
Remote Sensing: P. Laviolette, J. Dellue.

Panel 4: Modelling
Chairman: A.R. Robinson
Panelists: M. Gerges, P.M. Rizzoli, T. Kinder, R. Purini, U. Unluata C. Koutitas

GENERAL DISCUSSION — A.R. Robinson

RECOMMENDATION — J. Gonella

APPENDIX II

WORKSHOP ON PHYSICAL OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN (POEM)

Lucerne, 16 October, 1984

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APPENDIX III

RECOMMENDATION OF THE PHYSICAL OCEANOGRAPHY COMMITTEE OF ICSEM ON POEM PROGRAMME * +

The Physical Oceanography Committee (P.O.C.) acknowledges the Bureau of the International Commission for the Scientific Exploration of the Mediterranean Sea (ICSEM) for acting to study the Physical Oceanography of the Eastern Mediterranean (P.O.E.M.).

The P.O.C. asks the Bureau of ICSEM to act in order that the Steering Group, set up by the P.O.C. (list below): 1. be presented as the Group of Experts for POEM Programme to UNESCO and the IOC, and 2. could have support from these organizations for its future activities.

P.O.E.M. STEERING GROUP

Cochairpersons: A.R. ROBINSON and P. MALANOTTE-RIZZOLI

Members: H. CHARNOCK, J-C. GASCARD, M. GERGES, A. HECHT, H. LACOMBE, P. LAVIOLETTE, S. MORCOS, A. MICHELATO, M. OSMAN, W. ROETHER, A. THEOCHARIS, U. UNLUATA

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* Adopted by the Physical Oceanography Committee of ICSEM, 17 October 1984

+ Presented to the Bureau of ICSEM by President Gonella on 19 October 1984, where it was positively received. The Bureau requested to have the POEM Paris Organizing Committee report made available to it as soon as it was finalized so that endorsement could be given.

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